Leroux, D. 1984

An Assessment of the Fish Stocks in Rocky Lake, 1981.

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ABSTRACT

An assessment of the fish stocks in Rocky Lake, Manitoba was conducted by experimental netting in August and September, 1981. Of sixteen sets, twelve were duplicated from a previous study conducted in 1962 for comparison purposes. The study was initiated in response to user group concerns and also to provide baseline data for future management.

The study indicated that walleye and northern pike have decreased in size and abundance and are demonstrating characteristic responses to exploitation. Whitefish remain relatively unexploited and the population has considerable scope to absorb increased fishing pressure.

Rocky Lake is highly productive and appears capable of meeting an increased demand on its fish resources, however any increase will ultimately result in reduced angling quality over time. Future allocation of the lake's fish resource should only be considered if necessary to meet public demand for recreational based use.

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INTRODUCTION

Rocky Lake (54° 09'N, 101° 30'W) is located 45 kilometers north of The Pas on provincial highway # 10. It is well known as a year round family recreation area. The gradual shift from a solely sport fishing base to one of family recreation is a result of cottage, park and road development as well as its close proximity to The Pas. Sport fishing, however remains the major lake attraction and recreational activity. At present Rocky Lake supports 111 private cottages in two subdivisions, a 35 site provincial campground and two lodges with a total of 19 light housekeeping cabins.

The Fishery

Rocky Lake offers reasonably good angling opportunities for walleye (*Stizostedion vitreum vitreum*), pike (*Esox lucius*) and whitefish (*Coregonus clupeaformis*). Fishing takes place on a year round basis with winter angling becoming more popular each year. Open water anglers utilize all parts of the lake, excluding the large southwest basin (Figure 1) which is very shallow and eutrophic in nature. Winter angling tends to be concentrated along the southeast shore (Goose Bay), likely due to ease of access. Anglers equipped with snowmobiles utilize other areas of the lake, particularly those around Seagull Island and the point of the south peninsula.

Records indicate that Rocky Lake has been commercially fished at

different times in its history. There are commercial records for the years 1933 to 1936. A restricted commercial fishery was initiated in 1956 with the intent of harvesting primarily whitefish and ciscoes. However this fishery was discontinued in 1958 as a result of concerns for the sport fish populations. Request for commercial operations in subsequent years were denied based on these same concerns.

In the early 1960's studies were conducted to determine the feasibility of a large scale rough fish removal fishery utilizing trap nets (Sunde, 1962). Schlick (1965) also conducted an experimental whitefish removal program and both of these studies determined that a whitefish removal program would not be feasible. An experimental operation was again conducted in 1976 by the Branch at the request of the Saskatchewan River Fishermens' Association. Somewhat different from previous attempts, this fishery was operated by commercial fishermen (S.R.F.A.) and monitored by the Fisheries Branch. A quota of 5,000 kg of whitefish was set and all sport species taken were turned over to the Crown. Following initial success, this fishery has met with limited success, primarily due to lack of effort. The fishing takes place in the fall over selected whitefish spawning grounds and is limited to three licences and 134 mm mesh.

Bait fishing has also been an established commercial use on Rocky Lake since 1976. Two key areas account for all the minnow production taken from the lake, those being Bignell Creek (major inlet) and Rocky Creek (major outlet). The bait block licencing system places these two locations in separate blocks and are presently fished by two operators.

Study Area

Rocky Lake is situated with its northern portion lying in an Ordovician formation while its southern part is located in a Silurian formation. The surface deposits are primarily limestone and degraded Rendzina soils. The surrounding vegetation i typical northern coniferous forest with some mixed deciduous (Weir, 1960).

Rocky Lake has a surface area of 11,687 hectares. The maximum depth is 9.8 meters with a mean depth of 4.4 meters. Rocky Lake is a highly productive lake as a result of its limestone base, however only the northern basin appears to be important for recreational use including angling as the large south basin is very shallow and eutrophic in nature.

The purpose of the study was to assess the current status of the fishery and to evaluate changes in fish stocks over a 20 year period by comparison to previous surveys. The information provided by the study will provide an updated baseline for use in future evaluations and lake allocation. An additional purpose was to recommend a management strategy for future years.

MATERIALS AND METHODS

The study was conducted between August 4 and September 14, 1981. Standard gangs composed of 22.8 meters each of 51 mm, 77 mm, 89 mm, 108 mm, 121 mm and 134 mm (stretched measure) gillnets were set in 16

locations during the study (Figure 1). The time of set and lift as well as depth were recorded for each set. The average set time was 25 hours (range 21 to 49.5 hours). Details on the set locations are given in Table 1. Of the 16 set locations, 12 were duplicated from the 1962 survey conducted by Sunde (1962) for comparison purposes. The set locations used covered every available habitat type and were not species selective.

Northern pike, walleye and whitefish were sampled for fork length (to the nearest 1 mm), round weight (to the nearest 10 g), maturity and sex. A total count by mesh size was made of all species caught. For ageing purposes, the first two dorsal spines were collected from walleyes, pelvic fin rays from whitefish and cleithra from northern pike. The structures were stored in envelopes marked with the sample information and age determination was done at a later date.

In the lab, the dorsal spines and fin rays were mounted in epoxy, sectioned and the annuli counted on an image produced by a microprojector. Cleithra were soaked in hot water, cleaned, dried then examined under a dissecting scope set at a magnification of ten times.

Length-weight relationships were determined from the following equation:

$$\log w = a + b \ (\log L)$$

where : w = round weight in grams

a = y - intercept

b = slope

L = fork length in millimeters

The condition factors (CF), which indicate a relative measure of robustness, were calculated for each fish from the formula:

$$CF = \text{Weight} \times 10^5 / \text{Length}^3$$

Survival rates were calculated using both a regression model and methods outlined by Robson and Chapman (1961).

Water samples were collected from ten random locations on the lake. These were forwarded to the Technical Services Lab for residue analysis. The mean value for filterable residue was used in calculating total lake production. The morphoedaphic index (MEI) and maximum sustainable yield (MSY) were calculated according to Ryder's (1965) formula for moderate to intensively fished lakes. The metric unit regression formula used to calculate MSY is as follows:

$$MSY = 1.383\ (MEI^{.47441})$$

The bathymetric map (Figure 2) was compiled in an earlier survey by Schlick (1965).

RESULTS

CATCH

A total of 1064 fish were caught in 16 sets during the study (Table 2). Details on the catch and catch per unit effort are given in Table 3. Seven species were represented in the catch of which

white suckers (*Catostomus commersoni*) were the most numerous, comprising 32 percent of the total catch. Northern pike and walleye followed, representing 29 and 21 percent, respectively, of the catch. Sport species (walleye, pike and whitefish) comprised 62 percent of the total catch. Yellow perch (*Perca flavescens*) and burbot (*Lota lota*) were only incidental catches on two occasions (Table 3).

The overall catch per unit effort was 46.7 fish per 100 meters of gillnet per 24 hours set time. There was no relationship between depth and catch per unit effort (Table 1). The three smaller mesh sizes proved the most effective in catching all species however in the case of walleye and pike, these species are easily caught in small mesh nets through teeth entanglement.

WALLEYE

Length-Weight Relationship

The length-weight relationship for walleye from Rocky Lake is shown as follows:

log Weight = -11.8651 + 3.0854 (log Length)

The mean condition factor for Rocky Lake walleye was 1.17 (sexes combined).

Age Composition

The age-frequency distribution for walleye is illustrated in Figure 3 and shows a distribution skewed to the left. Age classes 5

and 6 show strong representation in the distribution. Details on the age-frequency distribution are given in Table 4. Walleye from Rocky Lake had a mean age of 6.7 years and ranged from 3 to 13 years inclusive.

Growth

Growth in length and weight for Rocky Lake walleye is illustrated in Figure 4. Walleye growth is compared to growth of other selected walleye populations in Figure 5. Data used in these comparisons are based on dorsal spine ages only. The slope of the length-weight regression line (b = 3.0854) indicates a positive allometric growth, that is walleye from Rocky Lake tend to increase their weight to length ratios over time.

Sex and Maturity

The sex ratio (females to males) for walleye was 1.2:1 for the entire sample (Table 4). Females outnumbered males in most age classes and both males and females were represented in all age classes. Both males and females reached 100 percent maturity at age 8 (Table 4). A few fish past this age did not appear to be sexually mature at the time of sampling and may not have spawned that spring.

Survival

The catch curve for walleye is illustrated in Figure 3. A segment analysis as outlined by Robson and Chapman (1961) yielded a survival rate of 73 percent (using ages 7 - 13). The linear regression method applied to the same segment resulted in a survival rate of 63 percent.

NORTHERN PIKE

Length-Weight Relationship

The length-weight relationship for northern pike from Rocky Lake is shown as follows:

log weight = -10.4487 + 2.7701 (log Length)

The mean condition factor for Rocky Lake pike was 0.7 (sexes combined).

Age Composition

The age-frequency distribution for pike is shown in Figure 6 and shows a distribution slightly skewed to the left. The distribution shows a comparatively limited range of ages with the majority of fish taken falling between ages 3 to 7. Details on the age-frequency distribution are given in Table 5. Pike from Rocky Lake had a mean age of 4.9 years and ranged from 3 to 10 years inclusive.

Growth

Growth in length and weight for Rocky Lake pike is illustrated in Figure 7. Northern pike growth is compared to growth of other selected pike populations in Figure 8. Data used in these comparisons are based on pelvic fin ray or cleithra ages. The slope of the length-weight regression (b = 2.7702) indicates a negative allometric growth, that is pike tend to decrease their weight to length ratios over time.

Sex and Maturity

The sex ratio (females to males) for northern pike was 0.8:1 for the entire sample (Table 5). The proportion of females remained fairly constant throughout the sample, however males were absent from the sample past the age of 8 years. Both sexes reached full sexual maturity at age 7.

Survival

The catch curve for northern pike is illustrated in Figure 6. Using methods outlined by Robson and Chapman (1961) for catch curve analysis yielded an annual survival rate of 21 percent (using ages 6 - 9). A regression analysis of this same segment yielded a survival rate of 24 percent.

WHITEFISH

Length-Weight Relationship

The length-weight relationship for whitefish from Rocky Lake is shown as follows:

log Weight = -12.7349 + 8.2847 (log Length)

The mean condition factor for Rocky Lake whitefish was 1.70 (sexes combined).

Age Composistion

The age-frequency distribution for whitefish is illustrated in Figure 9. The distribution is skewed to the right with the majority of fish falling between ages 10 to 13 inclusive. The weak year

classes in the younger years may be explained by the small sample size (N = 111). Details on the age-frequency distribution are given in Table 6. Whitefish from Rocky Lake had a mean age of 10.4 years and ranged from 4 to 16 years (N = 111).

Growth

Growth in length and weight for Rocky Lake whitefish is illustrated in Figure 10. Whitefish growth from Rocky Lake is compared to growth of other whitefish populations in Figure 11. Growth is rapid in the early year classes as indicated by the elevation of the curve, then reached an almost asymtotic growth at age 14.

Sex and Maturity

Female to male ratios fluctuated with each age class but males were generally more dominant. The female to male ratio for whitefish was 0.76:1 for the entire sample (Table 6). Maturity data was not conclusive, however mature females were evident at age 5 while mature males do not appear until age 8. Both sexes showed 100 percent maturity by age 10.

Survival

The catch curve for whitefish is illustrated in Figure 9. Due to the irregularity of the catch curve, a segment analysis as outlined by Robson and Chapman (1961) was used to calculate the survival rate. Using this method yielded a survival rate of 35 percent (for ages 12 - 14). The linear regression method applied to the same segment yielded a survival rate of 27 percent.

PRODUCTIVITY

The mean depth of Rocky Lake (4.4) falls within the range of mean depths stated by Ryder et al (1974) as acceptable for calculating the morphoedaphic index (MEI). The mean filterable residue value for ten samples from Rocky Lake was 254, resulting in an MEI of 57.7. When the MEI is applied to Ryder's (1965) equation for maximum sustainable yield (MSY), a value of 9.47 kg/ha or 111,000 kilograms per year (rounded off) for all species is derived, based on a surface area of 11,687 hectares.

DISCUSSION

CATCH

A comparison of catch data between the 1962 and 1981 surveys is presented in Table 7. The catch per unit effort data for the present study yielded a mean of 46.7 (number/100 meters/24 hours). Data from the 1962 survey were not available in similar units therefore the catch per unit effort data was calculated in units of catch per 100 meters of gillnet. The comparisons presented in Table 7 indicates that the catch per unit effort has decreased to one half that reported by Sunde (1962).

It should be noted that although mesh sizes and set locations were similar in both studies, time frames differed. Sunde's netting was conducted in October as compared to August and September for the present study. The purpose of Sunde's (1962) study was two fold; to

determine the abundance of game fish as well as testing the practicality of large scale rough fish removal by trap nets on a commercial fishing basis, primarily focused on whitefish. As a result, the catches of whitefish in the 1962 survey were higher as whitefish were concentrated in the spawning grounds during this time and net locations were set in some of these areas.

It is not known if the difference in time frames affected catches of the remaining species, however assuming that catches of fish other than whitefish remained relatively unaffected by the one month time difference, catch per unit effort comparisons indicate a decrease in fish stocks except white suckers. The relative percent catch by species indicates little change for the three major sport and commercial species however there was a significant increase in white suckers and a decrease in ciscoes. The numbers of perch and burbot represented less than two percent for both studies.

WALLEYE

Condition factors describe the length-weight relationship or the relative robustness of the fish. Condition factors will vary depending on gonadal condition, fullness of the gut, the amount of fat reserves and the degree of muscular development. The mean condition factor for Rocky Lake walleye (1.17) is higher than those reported by Hagenson and O'Connor (1980) for three Manitoban walleye populations. Colby et al (1979) reported that condition factors for North American walleye populations ranged from 1.26 to 1.85 however these data are

based on standard length which results in higher condition factors than those based on fork length.

Walleye from Rocky Lake yielded a length-weight regression slope of 3.08 indicating a positive allometric growth, that is they tend to increase weight at a faster rate than length over their life span.

A comparison of walleye growth from Rocky Lake to other selected walleye populations is shown in Figure 5. The comparison is valid as all ages used were determined from otoliths. Walleye from Rocky Lake show a comparatively faster growth rate than those populations used in the comparison except Reed Lake, although its growth curve is very similiar to that of Rocky Lake.

Analysis of the catch curve for walleye from Rocky Lake yielded an annual mortality rate ranging from 27 percent to 37 percent (using ages 7 to 13). Colby et al (1979) summarized walleye data from various North American populations and listed annual mortality rates ranging from 13 percent to 84 percent with common mortality rates ranging between 40 percent to 55 percent. Rocky Lake walleye mortality rates are lower than this common range reported and is likely due to the wide range of age classes used in the calculation. Lysack (1980) calculated mortality rates of 64 percent (based on scale ages) for a heavily exploted walleye population from Cedar Lake, Manitoba.

Colby et al (1970) found that age groups 3 to 4 constituted the majority of the adult population vulnerable to sampling gear in most

lakes examined in North America and that the numbers in age groups greater than 4 generally tend to decrease with each subsequent age group. Data from Rocky Lake indicates a modal age of 6 years with the majority of the catch (62%) represented by ages 5 to 7 inclusive. This variation is likely a result of latitude variation in growth as growth is slower in the northern latitudes. The age-composition of Rocky Lake indicates a lack of older aged fish when compared to other Manitoba lakes and a lower mean age than those reported by Hagenson and O'Connor (1980 and 1981) and Gaboury (1982) for the seven populations they studied (range 9.1 to 11.2). This younger aged population in Rocky Lake is likely a result of exploitation which in this case is primarily angling.

A comparison of the mean size of walleye from the present study to that reported by Sunde (1962) shows that the mean weight of walleye has decreased from 1.14 kilograms in 1962 to 0.74 kilograms in 1981. This drop in mean size is also likely due to the angling exploitation.

In summary, walleye have decreased significantly in abundance and size since the 1962 survey. Walleye from Rocky Lake are showing slightly higher mortality rates, comparatively fast growth and a population lacking older large fish when compared with other walleye populations. These factors would indicate that the walleye are demonstrating characteristic responses to the present level of exploitation yet are not considered to be in any stress. The high productivity of the lake and the excellent habitat available are likely factors contributing to the ability of the walleye stocks to handle the present level of exploitation.

NORTHERN PIKE

Condition factors for northern pike from Rocky Lake are similar to those reported for Tramping Lake (Leroux, 1982), Wekusko Lake (Blunt, 1976) and those reported by Hagenson and O'Connor (1980 and 1981) for lakes surveyed on the east side of Lake Winnipeg. This would indicate a similar quality of environment for these lakes.

The length-weight relationship for northern pike from Rocky Lake indicates a negative allometric growth, that is pike tend to increase length at a faster rate than weight during their lifespan.

The growth rate comparison presented in Figure 8 shows that Rocky Lake pike have a rapid growth in the early ages as evidenced by the elevation of the curve. Growth is also comparatively fast in the older age classes and only slightly lower than that reported for Family Lake (Hagenson and O'Connor, 1980).

Analysis of the catch curve yielded an annual mortality rate ranging from 76 percent to 79 percent for the two methods used. Toner and Lawler (1969) stated that even when fishing pressure in pike populations is low, the total mortality appears to be 50 percent. Based on this, the pike from Rocky Lake exhibit a high mortality rate which could be attributed to moderate-heavy levels of exploitation.

The age-frequency distribution (Figure 6) for northern pike indicates a population with a limited range of ages and the majority

of pike falling in age classes 3 to 6 inclusive. Scott and Crossman (1973) summarized data on northern pike and gave life expectancies of southern populations ranging from 10 to 12 years. Rocky Lake would fall within this range for ages but by latitude would be considered a northern population. It appears that older larger fish are absent from the sample, however catch data indicates that pike are numerous.

A comparison of the mean size of pike from the present study to that reported by Sunde in 1962 indicates that the mean weight of pike taken in experimental nets dropped from 2.6 kilograms in 1962 to 0.8 kilograms in 1981. Sunde (1962) stated that the average size of pike from his survey was somewhat poor and that this small size was causing concern among lodge operators at the time.

In summary, northern pike in Rocky Lake appear to be exhibiting signs of heavy exploitation. Mortality rates are somewhat higher than normal; growth rates are high, particularly in the younger ages; the majority of fish represented in the sample are concentrated in 3 age classes and there is a lack of older trophy size fish. As with walleye, the effects of exploitation are very noticeable and the high quality habitat available has been a key factor in maintaining the stocks.

WHITEFISH

Catch curve mortality rates calculated for whitefish from Rocky Lake yielded a mean of 69 percent using the two methods described. In using gillnets, young and old fish are not as susceptible to capture

as the intermediate year classes therefore the catch curve mortality rates are usually overestimates. In addition, mortality rates based on primarily older fish, such as those calculated in this case, tend to be higher. It is likely then that estimates for Rocky Lake are too high and would fall closer to the range for unexploited populations as reported by Healey (1975).

Growth of Rocky Lake whitefish is compared to growth of other selected whitefish populations in Figure 11. Rocky Lake whitefish exhibit a growth rate indicative of moderate to light exploitation. Growth in the early years appears very rapid as indicated by the elevation of the curve, however this may be a sampling artifact resulting from the low sample numbers in these age classes.

The age structure indicated in Figure 9 shows a population of old fish. A mean age of 10.4 years is higher than those found in similar studies done in the Northwest Region on both exploited and unexploited whitefish populations (range 5.9 to 9.3 years). A population composed of older aged fish indicates that no compensatory response has occurred resulting from the present level of exploitation and the population has considerable scope to absorb increased fishing pressure.

Maturity data suffers from the problem of errors in determining the maturation level of individual fish based on observation. In addition, no maturity data prior to the present study are available for comparison. A comparison, however, to Healey's (1975) synopsis of whitefish data indicates that Rocky Lake whitefish, in general, mature

at an age similar to unexploited populations from northern and central latitudes (range 3 - 10, mean 6.2 years).

In summary, Rocky Lake whitefish stocks appear healthy and do not show any typical compensatory responses to exploitation. The population, in fact appears to be in an almost climax situation and has considerable scope to absorb increased fishing pressure.

PRODUCTIVITY

Chemical analysis and maximum sustainable yield calculations indicate that Rocky Lake is a highly productive lake with a calculated annual MSY of 111,000 kilograms of all species. Ryder's (1965) equation was based on data that included the total weight of all species harvested by angling, commercial and domestic fishing. Experimental commercial fishing from 1976 to 1981 has had a limited production ranging from 285 to 5632 kilograms. The majority of harvest from Rocky Lake occurs from angling with the target species being walleye and pike. As these two species comprised a total of 51 percent of the catch by number in the present study, this figure can be applied to the MSY, yielding an annual production for sport species of 56,600 kilograms. However, species partitioning of MSY must be viewed with extreme caution. In view of overall lake productivity and the target species (pike and walleye) it is possible to suggest that angling quality is of more significance than concern for over-exploitation.

MANAGEMENT IMPLICATIONS

Rocky Lake is presently meeting a variety of seasonal and user group demands successfully. The lake is highly accessible and provides a reasonable or moderate level of angling quality. Rocky Lake could perhaps be best described as a multiple use, family fishery.

Recreational angling, the primary use of the lake, presently occurs in both open water and winter seasons in one of three forms - local day use, campers and cottagers. Winter angling has become very popular on the lake in recent years and is of particular value to local area residents. While a creel census estimate of harvest levels is not available, local day use and campground anglers are thought to be the major harvest group. Angling pressure from these groups throughout the year is expected to remain constant or even increase in future years. An angler survey conducted on Clearwater Lake in 1983 indicated that cottage owners did not form a significant portion of the total anglers utilizing the lake. While it is expected that this proportion would be higher on Rocky Lake due to the type of fishery, it is assumed, based on the Clearwater survey, that cottagers are of lesser importance relative to harvest levels than other recreational users. Cottages are a relatively new development on Rocky Lake, being first established in 1978.

Commercial sport fishing was first established on Rocky Lake in the 1950's with the development of two lodges, both of which remain currently active. As a result of increased accessibility and

decreased angling quality over the years, the lodges have undergone a shift in emphasis from a strictly sport fishing base to that of a family recreation base. Some of the lodge guests also angle on outlying lakes, particularly those located on the Mitchell Lake road. The shift has likely reduced the lodges' overall contribution to angling harvest levels and this use is now considered secondary in volume to local day users and campers. However, both lodges remain viable light housekeeping facilities oriented toward family groups and the fisheries resources of Rocky Lake still provide the main basis for their income and existence.

Rocky Lake has also been utilized in recent years by a restricted commercial net fishery based on whitefish (Saskatchewan River fishermen). However, the fishing effort has been sporadic following the initial success in the fall of 1977 when the current fishery originated. Concurrent with the fall commercial net fishery and of more social significance, is a small Treaty Indian fishery for whitefish which is utilized by The Pas Indian Band. This may explain in part, the poor effort in the commercial net fishery as netting activities, in most years, likely relate more to domestic demand rather than economic viability.

Results of the biological data from this study indicate that pike and walleye are showing definite compensatory responses to the present levels of exploitation. Rocky Lake has never been known as a trophy fishery however the data indicates that the mean size and abundance of walleye and pike has shown a marked decrease since 1962. In view of the present status and the level of use and development, Rocky Lake

could not be managed as a high quality fishery. However given its high biological productivity, the lake appears capable of maintaining itself as a "family fishery" indefinitely if angling remains as the sole source of exploitation for sports species. The effects on sport fish populations of forage species exploitation by commercial bait fishing is unknown.

Whitefish (and cisco) stocks are composed largely of older aged fish, characteristic of under-utilized populations. A carefully controlled selective net fishery could ultimately improve the overall health of the whitefish population without affecting the other species. Due to the high quality of the whitefish available and the accessibility of the lake, such a fishery could likely provide reasonable economic returns on a seasonal (fall) basis to a limited number of operators. It is unlikely, however, from a biological perspective, that Rocky Lake would be able to sustain a high volume selective whitefish fishery and a restricted (non-sport species) net fishery can be difficult to develop and operate effectively. In addition, since the development of a winter sport fishery in the mid 1970's, incidental catches of large whitefish and cisco have created an added dimension to the Rocky Lake angling experience. Locally, the lake has become known as a producer of Master Angler whitefish and cisco (tullibee). The Manitoba cisco angling record was caught in Rocky Lake in 1983. A selected commercial net fishery would, no doubt, reduce the number of large whitefsh and cisco available to sport fishermen. It should be noted here that Treaty Indian (domestic) fishing represents a very small portion of the annual harvest on Rocky Lake and to date, has resulted in very few conflicts

or problems. In recent years, a few individuals generally harvest sufficient quantities to meet all the demands of The Pas Band. Present policy is such that Treaty Indian fishing received highest priority in the allocation of the fisheries resource.

Based on the above discussion and in view of the current provincial priorities for lake use, it is suggested that any future development, if required on Rocky Lake, could be allocated to day use/campground facilities and cottagers. Such development, while it may result in increased exploitation, may also simply accommodate existing use more adequately and thereby not substantially increase angling pressure. Ideally, development should not occur until a creel census could provide an estimate of present harvest levels and a measure of angling quality. Any changes could then be planned more appropriately based on allocation priorities and a pre-determined level of angling quality desired for the lake.

In view of its productive nature however, the lake appears capable of meeting an increased demand for these uses while sustaining reasonable angling quality. While the reduction in angling quality will be less noticeable than in other less productive lakes, it must be realized that increased development based on fishing will result in reduced angling success over time. In this regard, additional cottage development is the type of development least likely to significantly alter present angling quality.

In view of their established and long term use, existing lodges should be provided opportunity, where possible, to maintain or enhance

their viability through participation in the maintenance and operation of day use and campground facilities. However, operators should be discouraged from major capital investments in the form of lodge expansion as any surplus fish resources should be reserved for recreational angling groups.

Treaty Indian fishing must be allowed to continue and under present conditions with limited participation, does not pose any threat to fish stocks or angling quality. Changes in volume or methods of Treaty harvest should be closely monitored and discussed with The Pas Indian Band to prevent conflicts with other users.

Under the present arrangements, commercial net fishing should be given the lowest priority for use of Rocky Lake. The present fishery should not be expanded or encouraged and present operational restrictions should be maintained. Such a fishery is very difficult to enforce when operated in conjunction with the Treaty Indian fishing and would affect the recreational fishery for whitefish which should receive a higher priority of use.

RECOMMENDATIONS

1. All present uses should be allowed to continue.

2. A creel census would be useful to determine
   a) present harvest levels in relation to MSY
   b) the present and desired level of angling quality
   c) portion of harvest taken by various user groups

3. Additional allocation of the fish resource and any future lake development should only be considered if necessary to meet local recreational demands (e.g. cottage and day use facilities).

4. Existing lodges should be provided reasonable opportunities to maintain their viability (i.e. management of existing campgrounds) but expansion or development of any commercial sport fishing facility should be discouraged.

5. Commercial net fishing should be viewed as the lowest priority use on Rocky Lake.

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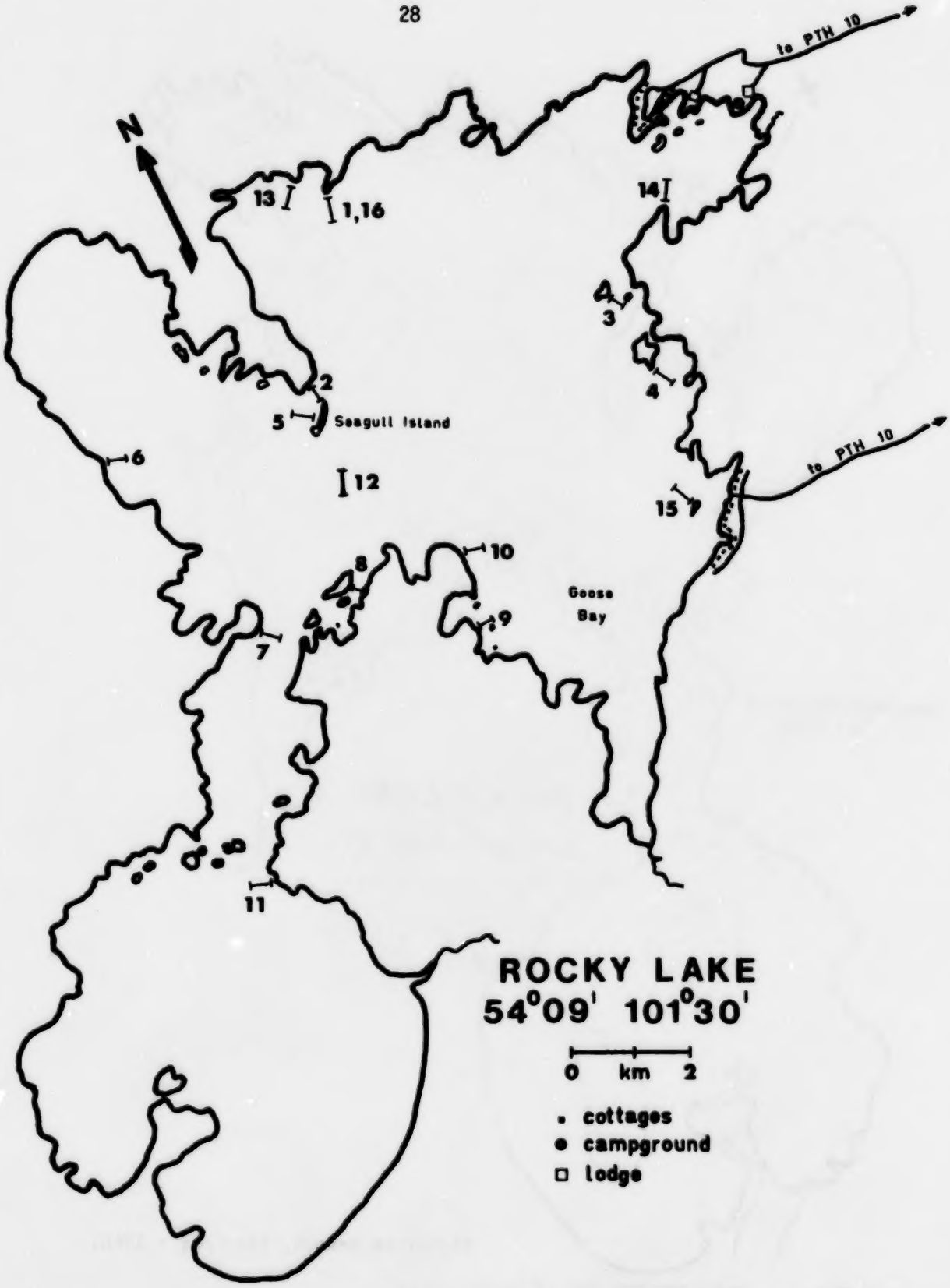


Figure 1. Map of Rocky Lake showing locations by set number of experimental nets, 1981.

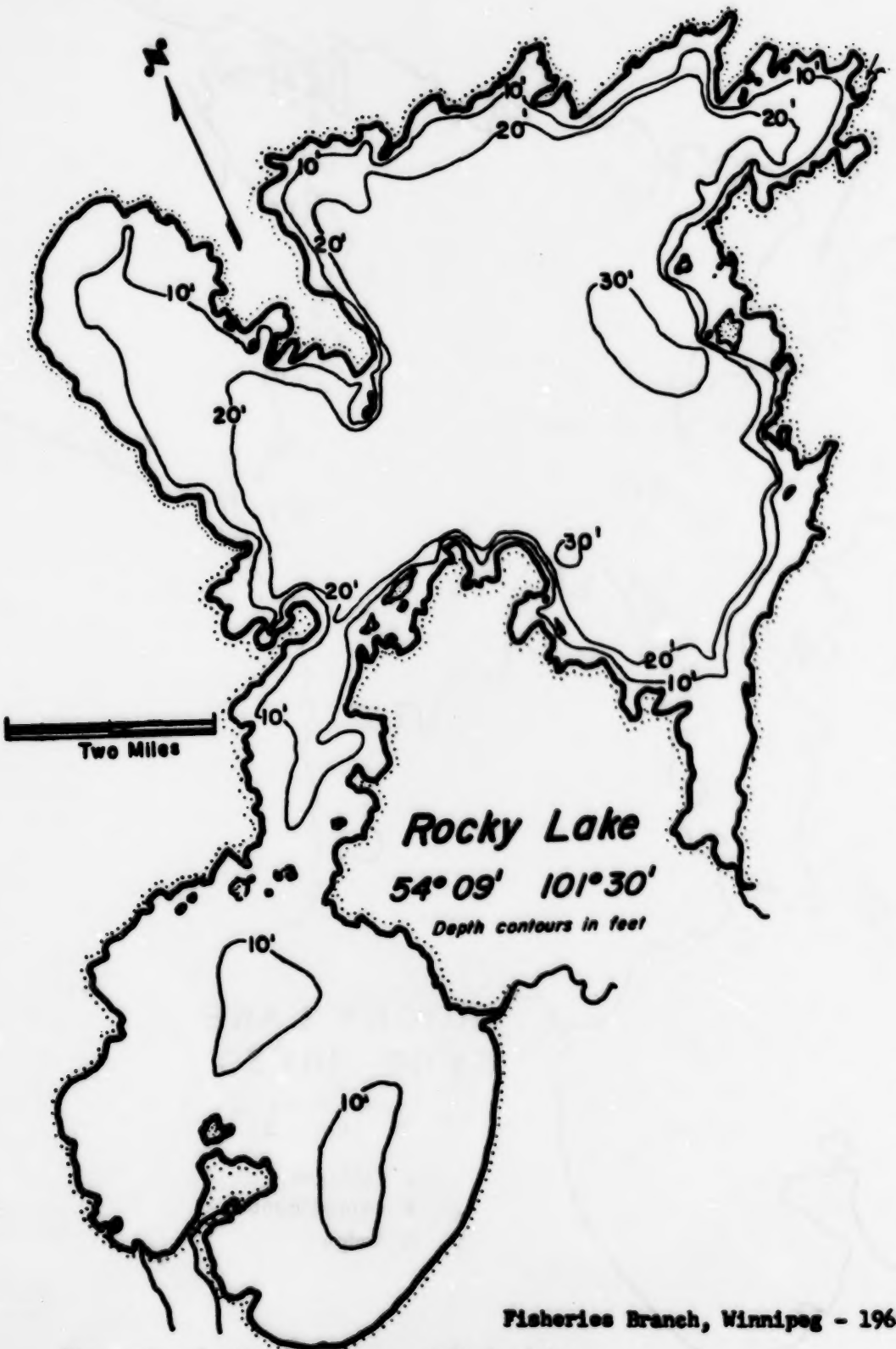
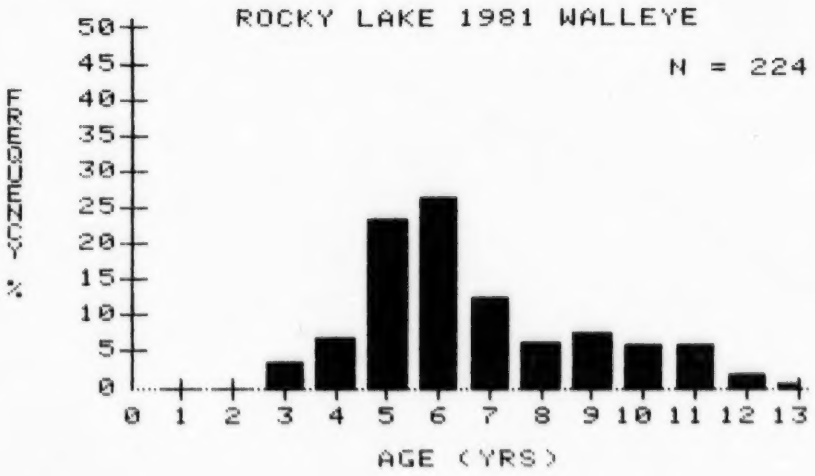


Figure 2. Depth contour map of Rocky Lake.



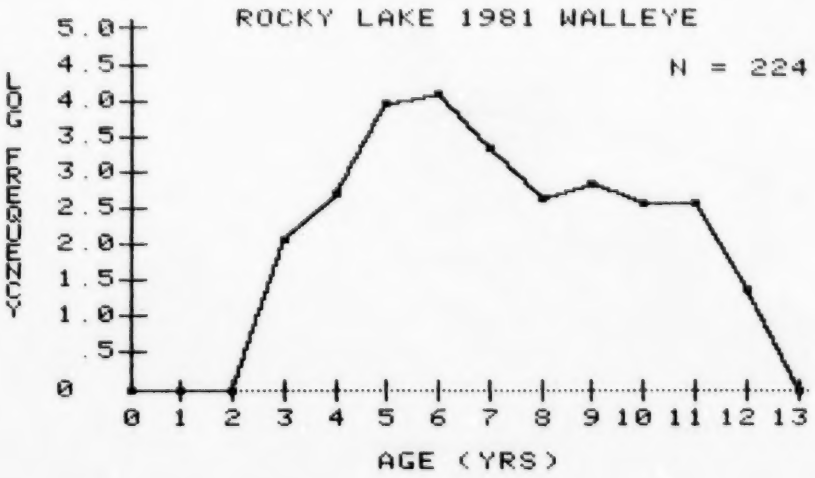
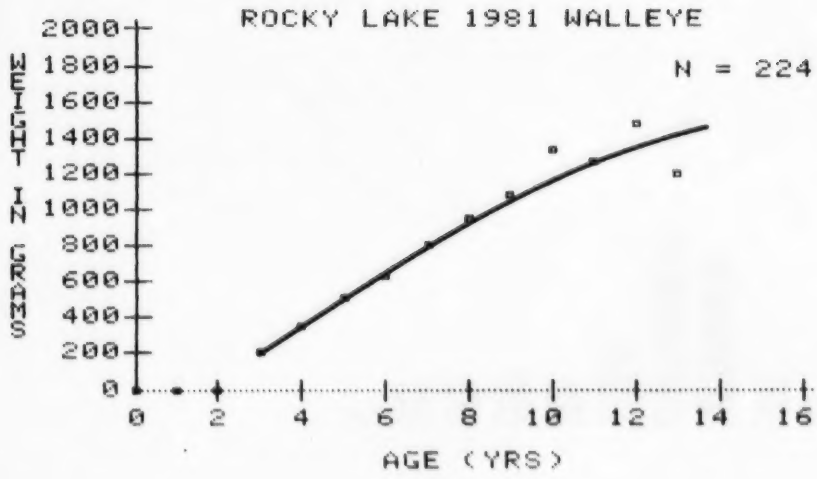


Figure 3. Age-frequency distribution and catch curve of walleye from experimental nets, Rocky Lake, 1981.



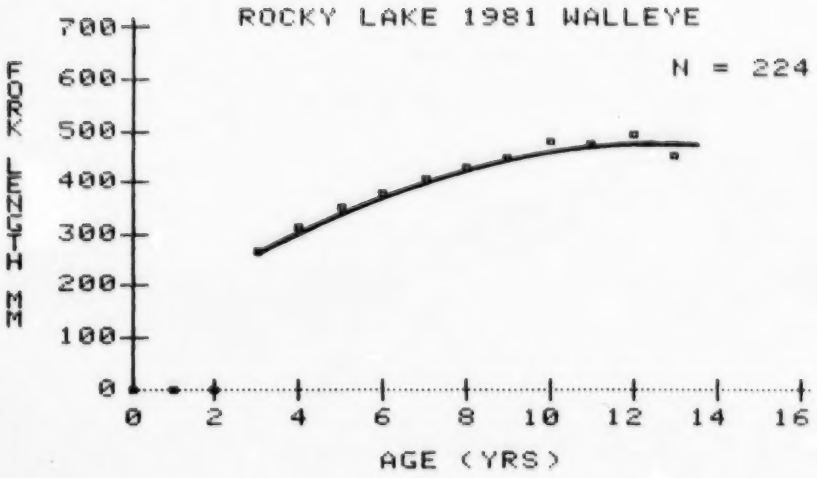


Figure 4. Growth in length and weight of walleye from experimental nets, Rocky Lake, 1981.

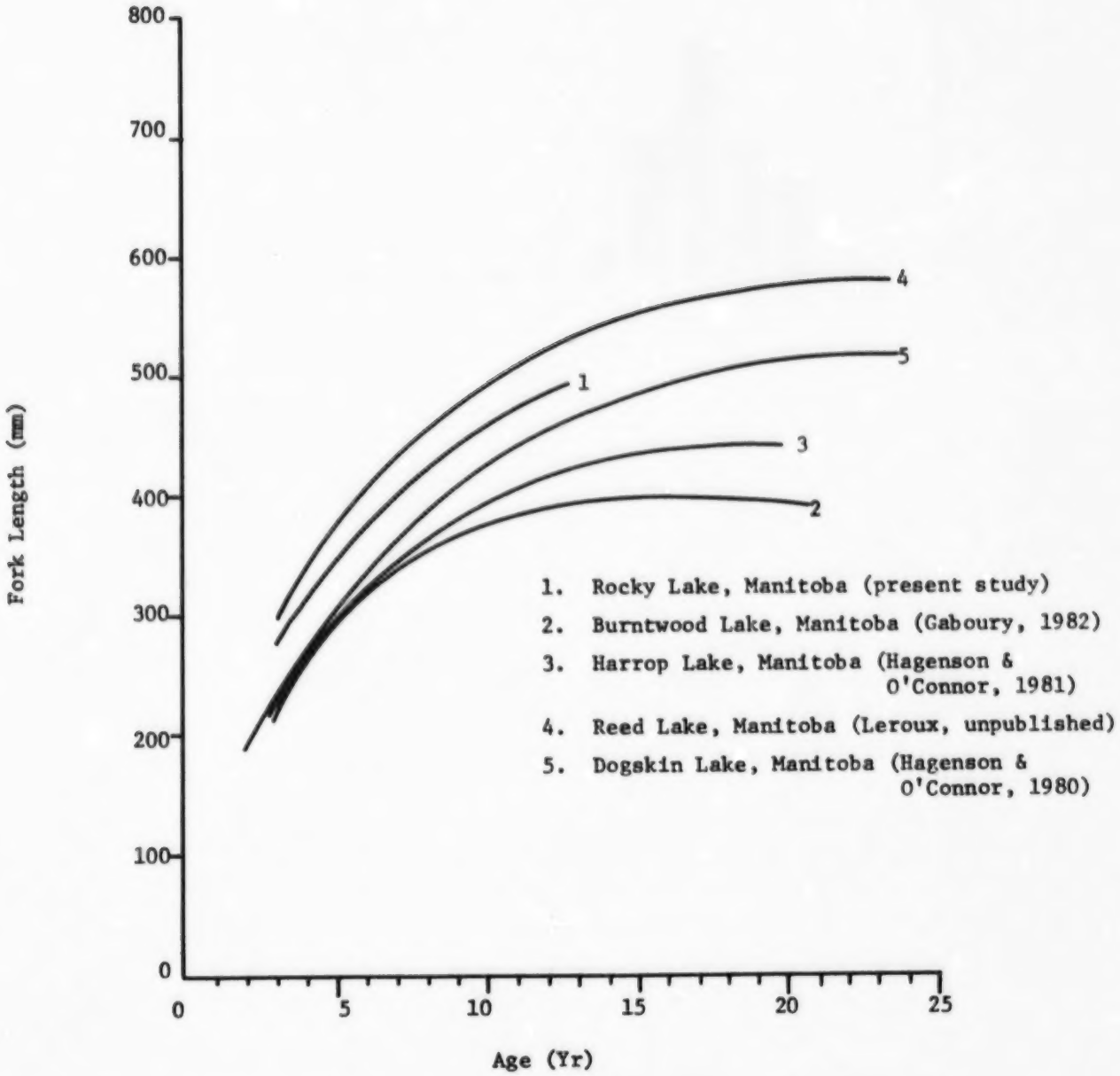
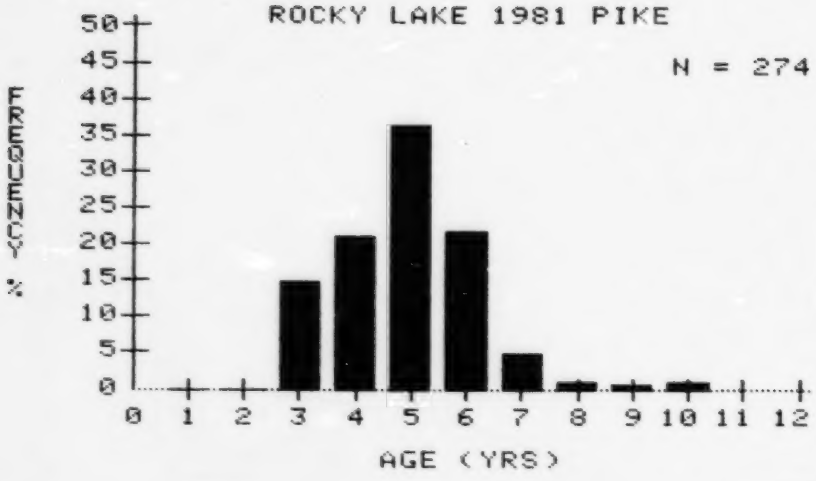


Figure 5. Comparison of walleye growth from Rocky Lake, Manitoba to other selected lakes in Manitoba.



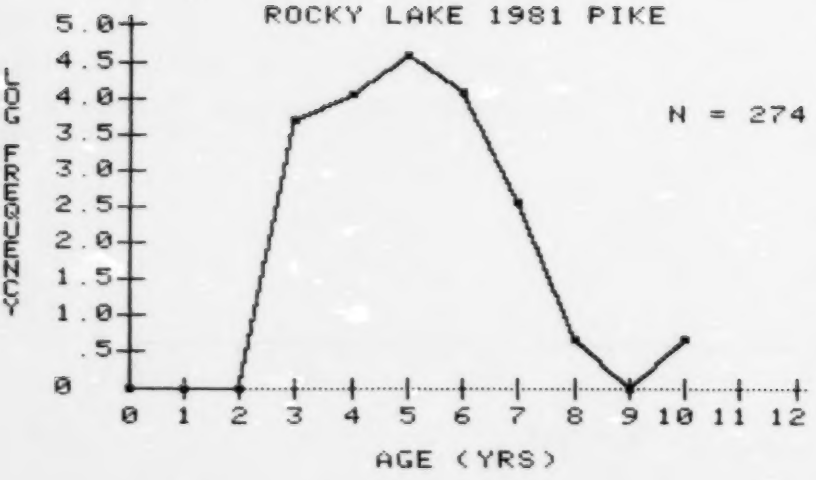
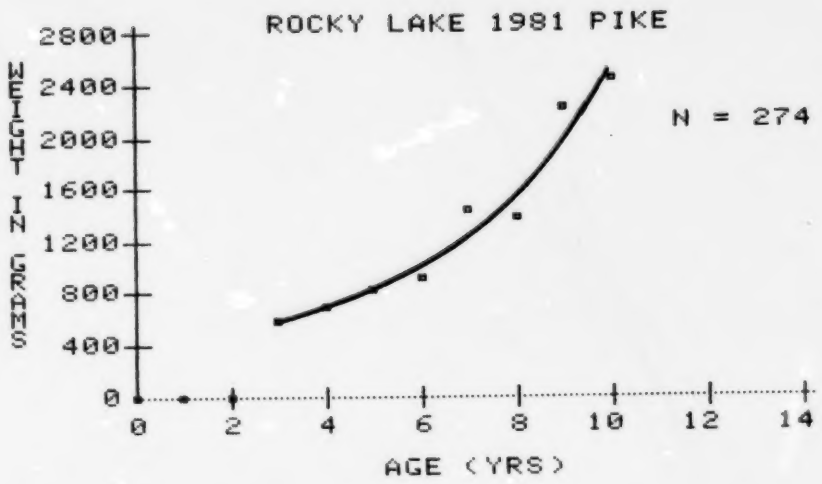


Figure 6. Age-frequency distribution and catch curve for northern pike from experimental nets, Rocky Lake, 1981.



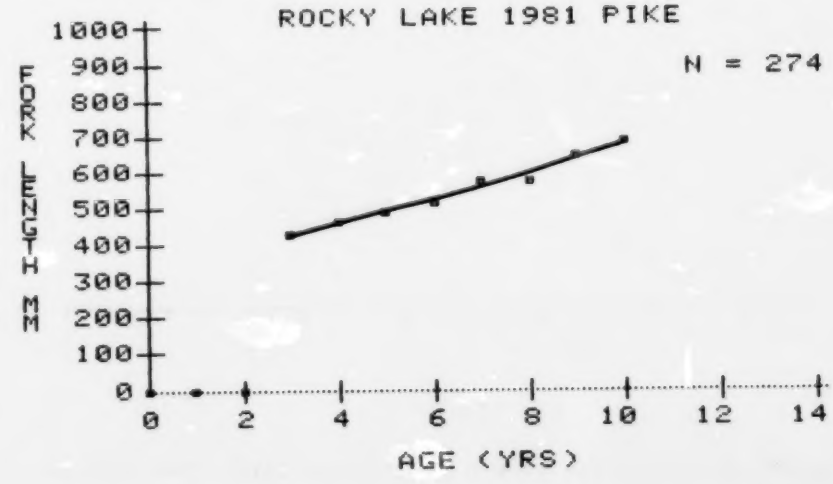


Figure 7. Growth in length and weight for northern pike from experimental nets, Rocky Lake, 1981.

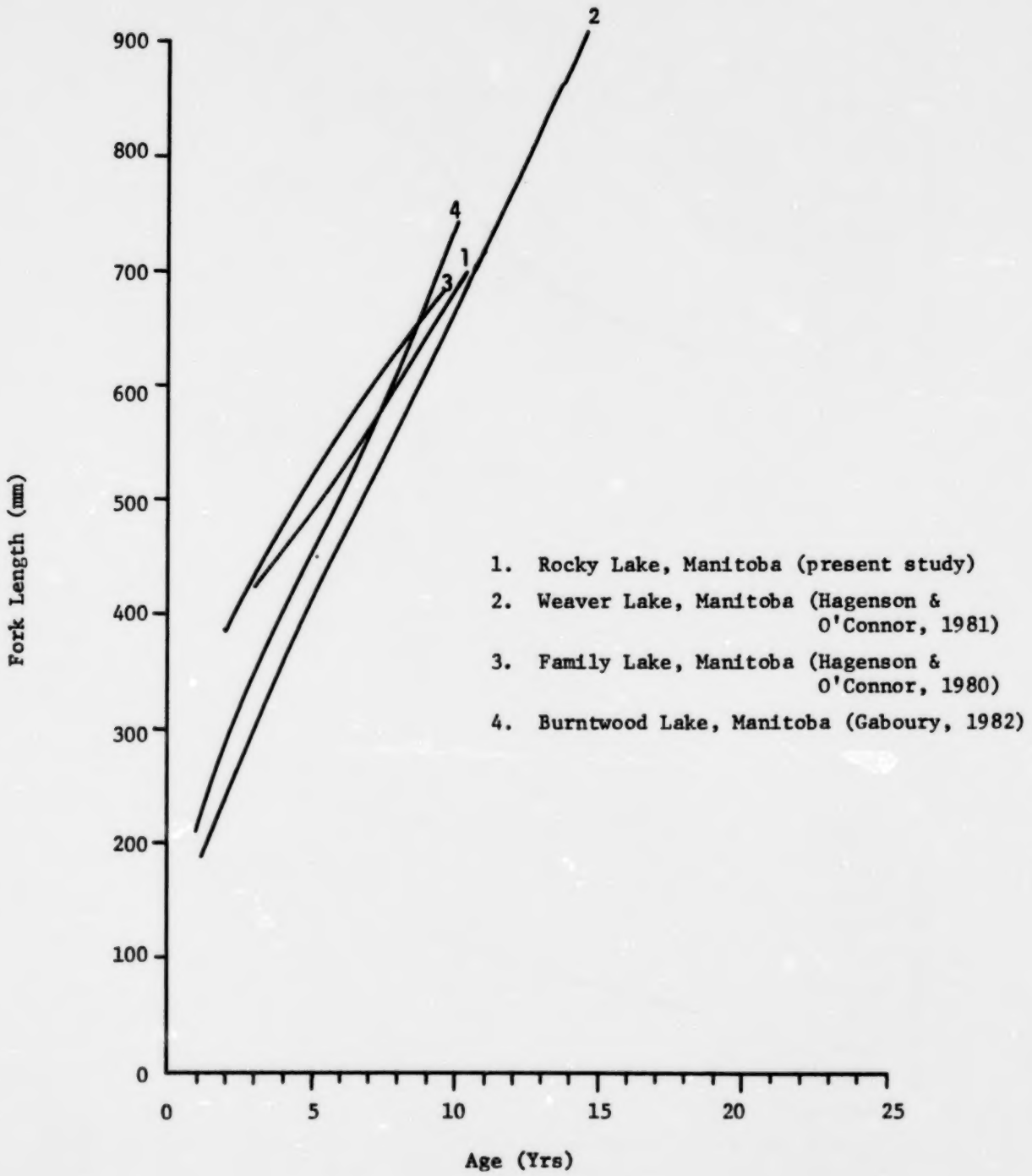
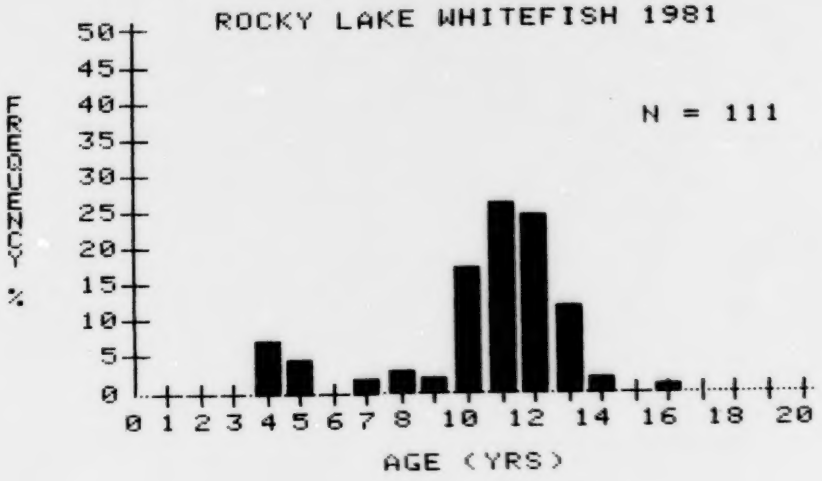


Figure 8. Comparison of northern pike growth from Rocky Lake, Manitoba to other lakes in Manitoba.



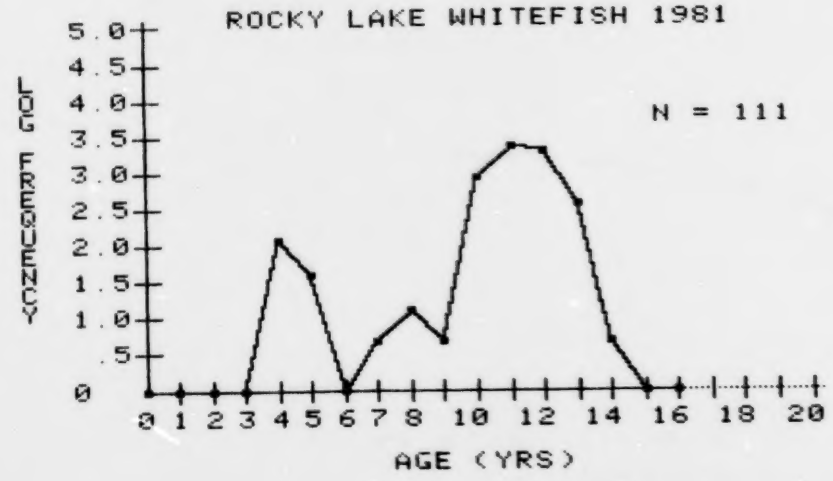
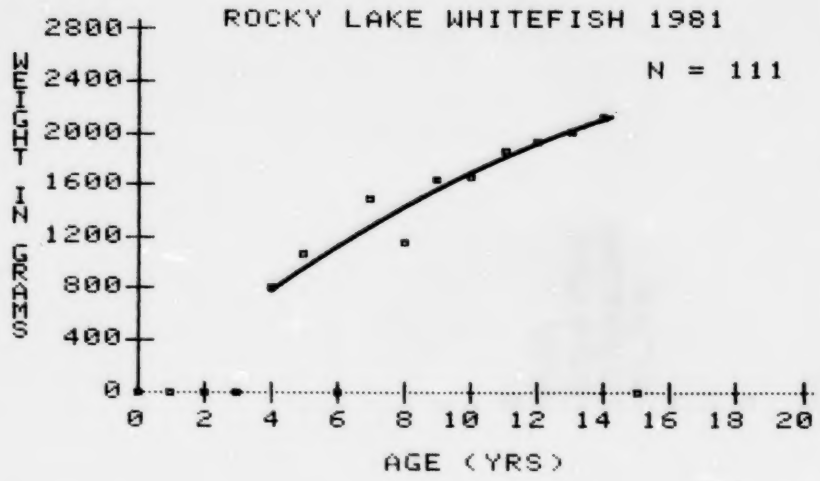


Figure 9. Age-frequency distribution and catch curve for whitefish from experimental nets, Rocky Lake, 1981.



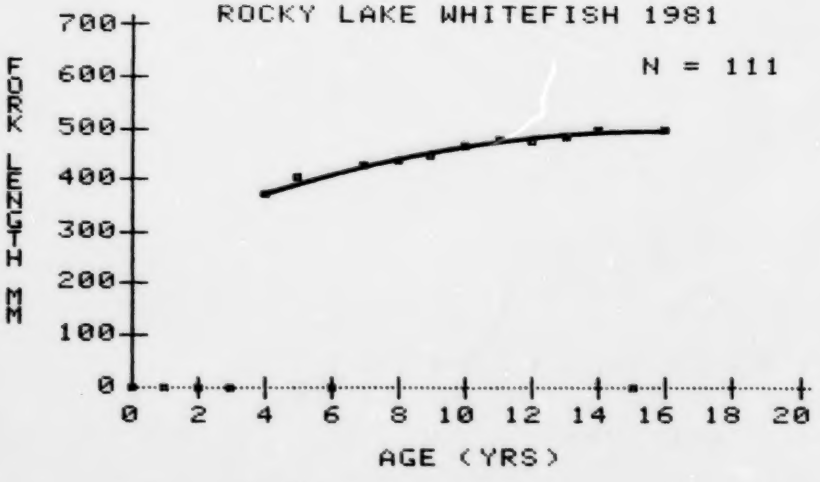


Figure 10. Growth in length and weight for whitefish from experimental nets, Rocky Lake, 1981.

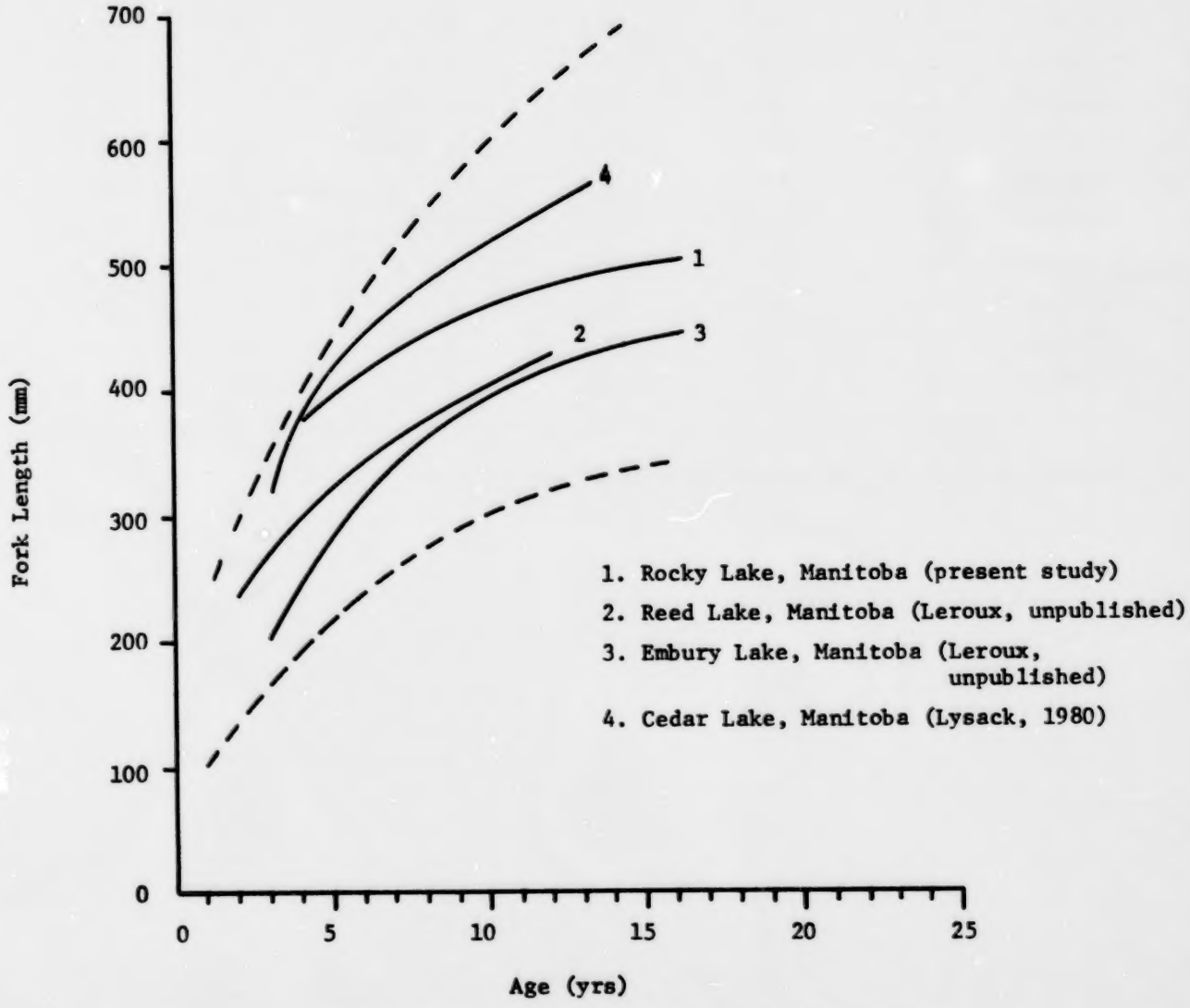


Figure 11. Comparison of whitefish growth from Rocky Lake, Manitoba to other selected lakes in Manitoba. Dashed lines represent the range of observed whitefish growth (Healey, 1975).

TABLE 1 . Summary of information on each set location, Rocky Lake, 1981.

Set Date (D/M/Y)	Location No.	Net Length (m)	Set Duration (hr)	Water Depth (m)	Total Catch	Catch Per Unit Effort[a]
04/08/81	1	137	22.0	3 - 6	75	59.7
05/08/81	2	137	23.5	3 - 6	102	81.2
05/08/81	3	137	24.0	3 - 3	44	35.0
06/08/81	4	137	22.5	5 - 7	73	58.1
10/08/81	5	137	24.5	6 - 6	74	58.9
10/08/81	6	137	22.0	0 - 4	59	47.0
17/08/81	7	137	24.5	0 - 4	65	51.8
17/08/81	8	137	25.0	4 - 4	55	43.8
18/08/81	9	137	21.5	0 - 2	39	31.1
18/08/81	10	137	21.0	1 - 8	72	57.3
19/08/81	11	137	23.0	0 - 2	73	58.1
19/08/81	12	137	22.0	7 - 6	76	60.5
31/08/81	13	137	49.5	0 - 5	82	65.3
02/09/81	14	137	25.0	6 - 7	51	40.5
02/09/81	15	137	23.0	3 - 7	34	27.1
14/09/81	16	137	26.5	3 - 6	79	62.9

[a]number of fish per 100 meters of gillnet per 24 hours.

TABLE 2. Total catch for each species by set location from experimental nets, Rocky Lake, 1981.

	1 No.	2 No.	3 No.	4 No.	5 No.	6 No.	7 No.	8 No.	9 No.	10 No.	11 No.	12 No.	13 No.	14 No.	15 No.	16 No.	Total
Walleye	31	25	33	14	8	3	4	6	12	29	-	21	2	9	6	25	228
Whitefish	10	12	-	2	30	5	13	7	2	6	9	2	9	1	4	1	113
Northern Pike	8	38	9	14	21	12	18	19	10	16	35	19	36	18	13	29	315
White Sucker	26	18	2	43	10	45	27	23	13	17	29	21	35	19	10	24	362
Cisco	-	9	-	-	5	5	1	-	1	4	-	13	-	4	1	-	43
Perch	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	2
Burbot	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1
Total	75	102	44	73	74	70	65	55	39	72	73	76	82	51	34	79	1064

TABLE 3. Total catch and catch per unit effort (CPUE) for each species by mesh size from experimental nets, Rocky Lake, 1981.

Species	51 mm		77 mm		89 mm		108 mm		121 mm		134 mm		Total	
	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE
Walleye *(Stizostedion vitreum)*	78	20.4	48	12.5	59	15.4	31	8.1	8	2.1	4	1.0	228	10.0
Whitefish *(Coregonus clupeaformis)*	19	5.0	17	4.4	11	2.9	19	5.0	24	6.3	23	6.0	113	5.0
White Sucker *(Catastomus commersoni)*	41	10.7	56	14.6	111	29.0	120	31.3	31	8.1	3	0.8	362	15.9
Northern Pike *(Esox lucius)*	84	21.9	120	31.3	76	19.9	23	6.0	4	1.0	8	2.1	315	13.8
Cisco *(Coregonus artedi)*	12	3.1	17	4.4	8	2.1	2	0.5	3	0.8	1	0.3	43	1.9
Yellow Perch *(Perca flavescens)*	2	0.5	-	-	-	-	-	-	-	-	-	-	2	0.1
Burbot *(Lota lota)*	-	-	-	-	-	-	1	0.3	-	-	-	-	1	0.0
Total	236	61.6	258	67.4	265	69.2	196	51.2	70	18.3	39	10.2	1064	46.7

[a] number of fish per 100 meters of gillnets per 24 hours.

TABLE 4. MEAN FORK LENGTH, MEAN ROUND WEIGHT, CONDITION FACTOR, MATURITY AND PERCENT FEMALES BY AGE FOR WALLEYE FROM EXPERIMENTAL NETS, ROCKY LAKE, 1981.

AGE		FORK LENGTH (MM)		WEIGHT (G)		CONDITION	MALES		FEMALES		PERCENT
(YR)	NO.	MEAN	SD	MEAN	SD	FACTOR	NO.	% MATURE	NO.	% MATURE	FEMALES
1	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-
3	8	268	10.1	211	566.5	1.09	3	0	5	0	63
4	15	312	27.4	345	1328.2	1.12	8	0	7	0	47
5	52	350	20.5	504	3657	1.16	24	17	28	7	54
6	59	377	20.4	635	4901.8	1.18	25	32	34	50	58
7	28	406	19.2	801	4201	1.19	12	42	16	75	57
8	14	428	17.2	951	3461.9	1.21	9	100	5	100	36
9	17	447	17.4	1074	4323.7	1.2	8	100	9	89	53
10	13	482	27.2	1330	4671.1	1.18	3	100	10	100	77
11	13	476	40.7	1266	4534.4	1.15	5	80	8	88	62
12	4	493	26.3	1475	2580.2	1.23	2	50	2	100	50
13	1	450	0	1200	0	1.32	1	0	0	0	0
TOTAL	224						100	43	124	51	55
MEAN	6.7 ^	389	57.6	738	336.4	1.17					

^ INDICATES MEAN AGE

LENGTH-WEIGHT REGRESSION

SLOPE:	3.08542135
Y-INTERCEPT:	-11.8650952
CORRELATION COEFFICENT	.988067318

TABLE 5. MEAN FORK LENGTH, MEAN ROUND WEIGHT, CONDITION FACTOR, MATURITY AND PERCENT FEMALES BY AGE FOR NORTHERN PIKE FROM EXPERIMENTAL NETS, ROCKY LAKE, 1981.

AGE		FORK LENGTH (MM)		WEIGHT (G)		CONDITION	MALES		FEMALES		PERCENT
(YR)	NO.	MEAN	SD	MEAN	SD	FACTOR	NO.	% MATURE	NO.	% MATURE	FEMALES
1	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-
3	40	426	47.9	581	3801.7	.73	22	50	18	33	45
4	58	457	39.2	693	5350.9	.72	33	85	25	56	43
5	99	488	38.1	817	8255.1	.69	53	74	46	63	46
6	59	511	31.1	916	7123.1	.68	20	75	39	59	66
7	13	573	61.5	1438	5257.2	.74	3	100	10	100	77
8	2	575	82.7	1385	1483.1	.71	1	100	1	100	50
9	1	646	0	2230	0	.83	0	0	1	0	0
10	2	684	178.9	2455	3140.6	.67	0	0	2	0	0
TOTAL	274						132	73	142	61	52
MEAN	4.9 ^	484	57.6	828	336.6	.7					

^ INDICATES MEAN AGE

LENGTH-WEIGHT REGRESSION

SLOPE:	2.77017441
Y-INTERCEPT:	-10.44872
CORRELATION COEFFICENT	.962295026

TABLE 6. MEAN FORK LENGTH, MEAN ROUND WEIGHT, CONDITION FACTOR, MATURITY, AND PERCENT FEMALES BY AGE FOR WHITEFISH FROM EXPERIMENTAL NETS, ROCKY LAKE, 1981.

AGE		FORK LENGTH (MM)		WEIGHT (G)		CONDITION	MALES		FEMALES		PERCENT
(YR)	NO.	MEAN	SD	MEAN	SD	FACTOR	NO.	% MATURE	NO.	% MATURE	FEMALES
1	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-
4	8	373	19.9	814	2197.9	1.56	4	50	4	0	50
5	5	404	16.8	1074	2158.8	1.63	4	50	1	100	20
6	-	-	-	-	-	-	-	-	-	-	-
7	2	430	48.1	1485	1563.1	1.83	0	0	2	0	0
8	3	438	25.1	1160	1687.2	1.43	2	100	1	100	33
9	2	449	18.4	1640	1655.5	1.81	0	0	2	0	0
10	19	465	21.3	1663	7144.7	1.65	9	100	10	100	53
11	29	479	11.4	1871	9951.3	1.7	19	100	10	100	34
12	27	477	11.8	1936	9974.6	1.78	19	100	8	100	30
13	13	482	13.3	2012	6991.4	1.79	5	100	8	100	62
14	2	501	.7	2130	2169.1	1.7	0	0	2	0	0
15	-	-	-	-	-	-	-	-	-	-	-
16	1	500	0	2150	0	1.72	1	0	0	0	0
TOTAL	111						63	94	48	92	43
MEAN	10.4 ^	464	35	1732	413.5	1.7					

^ INDICATES MEAN AGE

LENGTH-WEIGHT REGRESSION

SLOPE:	3.28469693
Y-INTERCEPT:	-12.7348867
CORRELATION COEFFICENT	.894118282

TABLE 7. Comparison of catch and catch per unit effort data between the 1962 and 1981 surveys on Rocky Lake. Data from 1962 was converted to metric units for the comparison.

Species	Total Catch		Percent Catch		CPUE[a]	
	1962	1981	1962	1981	1962	1981
Walleye	354	228	24	21	24.2	10.4
Pike	523	315	36	30	35.7	14.4
Whitefish	179	113	12	11	12.2	5.2
Cisco	252	43	17	4	17.2	2.0
White Sucker	139	362	9.4	34	9.5	16.5
Perch	0	2	0	0	0	0.1
Burbot	24	1	1.6	0	1.6	<0.1
Total	1,471	1,064	-	-	100.5	48.5

[a]CPUE = catch per 100 meters gillnet